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6 October 1980

Worldwide Report

ENVIRONMENTAL QUALITY

(FOUO 7/80)

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CONTENTS

CZECHOSLOVAKIA

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CHEMICAL INDUSTRY ANTIPOLLUTION ALTERNATIVES

Prague CHEMICKY PRUMYSL in Czech No 5, May 80 pp 261-263

[Article by Jindrich Hojer, Research Institute for Organic Compounds, Pardubice-Rybitvi: "Selected Problems Relevant to Introduction of "Wasteless" Technologies"]

[Text] The author deals with technical, economic and organizational problems related to implementation of technologies that do not pollute the environment. He uses examples to show how selected technical solutions can be used to reduce the amount of wastes.

Introduction

The current worldwide growth of industrial and agricultural production is beginning to be incompatible with protection of the environment. Annually hundreds of thousands of tons of pollutants and wastes are released into the atmosphere and into rivers and almost the entire world is declaring war against polluters of the biosphere, which also include the chemical industry.

In the CSSR the struggle to protect the living environment in the area of streams is waged primarily on the basis of the water law of 1973, in force since 1975, which within the framework of water management calls for use of both administrative measures (approval proceedings by water management organs) and economic measures (obligation to pay damages for releasing effluents at annual water consumption exceeding 15,000 cubic meters, monetary sanctions and direct penalties against personnel who cause the organization to fail to carry out one of its water management functions).

The chemical industry released in 1975 into water streams over 47,000 tons of insoluble substances, over 637,000 tons of soluble substances, corresponding to over 38,000 tons of BSK5 (biological consumption of oxygen) and over 135,000 tons of CHSK (chemical consumption of oxygen), accounting for a share in overall pollution by BSK5 of 36 percent, and in the case of insoluble substances to the extent of 23 percent. Fines for water pollution amount in the chemical industry up to 60 million Kcs annually per economic production unit. The subject of penalties in waste water are primarily the contents of insoluble substances, and biological consumption of oxygen.

In the Sixth Five-Year Plan the CSSR spent over Kcs 2 billion for environmental protection, in the Seventh Five-Year Plan the expenditure for the same purpose is to amount to Kcs 3 billion.

One of the approaches to solving the conflict between production and environment is, without a doubt, use of the so-called "wastefree" or "minimum waste" technologies. However, it appears sometimes as if this term is confused with a magic wand, a mere wave of which manages to solve all the problems relevant to the protection of the living environment. The subsequent test points out selected problems pertaining to the solution of this extremely important issue.

Generation of Unwanted Wastes

Unwanted wastes can be classified according to various criteria into individual groups, e.g., organic and inorganic waste, soluble and insoluble waste, or from the viewpoint of BSK5 and CHSK. For our purposes it appears expedient to determine the concept of generation of unwanted waste and divide the latter into categories according to their origin.

Waste Generated by Main or Secondary Reaction in Using Practically Stoichiometric Amounts of Initial Raw Materials

An example of generation of unwanted waste by main reaction in the sphere of dyes and paints intermediate products is Bechamp's classic reduction of aromatic nitro-substances to amino-substances during formation of ferro-ferric sludge, formation of hydrogen chloride in chlorination of organic substances, formation of alkalic sulfite during alkalic melting of aromatic sulfonic acids, etc. An example of the formation of unwanted substances by a secondary reaction is formation of naphtalene-sulfonic acid in the production of 2-naphtol, formation of diethylaniline in the production of monoethylaniline, etc. This category comprises in general also formation of unwanted polymer substances and condensation products.

Waste Generated Through the Necessity of Using Suprastoichiometric Amounts of a Single Raw Material

Use of excessive amount of one raw material against stoichiometry may be motivated by the need to accelerate the progress of a chemical reaction, cause a shift in chemical equilibrium, or by technological reasons (blendability of a reaction compound, use of one component as a reaction medium, transportation of material, etc.). An example of such technologies can be caustic fusion in an excess of alkaline lye, sulfonation of organic substances in sulfuric acid media, nitration in an excess of nitric sulfuric acid compounds, excess of ammonia in Bucherer's reaction, excess of alcohol in esterification, etc.

Waste Generated by the Necessity To Use Auxiliary Chemicals

This category can incorporate technological processes using auxiliary raw materials that can be liquidated only with difficulty, e.g., Sandmayer's reaction using Cu-cation or copper as catalyzer, anthraquinone chemistry using mercury compounds as catalyzer, etc.; further it includes operations in the chemistry of dyes and paints, such as salting out, liming, soda treatment, and acidifying. The latter operations applied to the production of the so-called lettered acids are the source of the greatest amounts of waste: turning out 1 ton of product generates approximately 12 tons of by-products, of which approximately 4 tons constitute solid inorganic waste, about 1 ton of organic waste and some 7 tons of inorganic waste dissolved in approximately 70 cubic meters of water. Thus, these operations are the most common source of the so-called salinity of waster waters. Let us point out that river water (fresh water) contains an average of 500 ppm of salts (i.e., 0.5 gram per liter), semisalty water in river estuaries into the sea around 1,000 ppm and sea water an average of 35,000 ppm. The above mentioned economic production unit releases with waste some 340,000 tons of inorganic salts per year, meaning that it "produces" around 10 million cubic meters of sea water, which corresponds to the capacity of a good size dam.

Waste From Physical Operations and Nontechnological Waste

This includes waste that can be categorized as distillation residue, residue from crystallization, extraction, residue from reconstituting of solvents, etc. Nontechnological waste comprises drippings from pumps and armatures, water from cleaning of facilities, steaming of storage tanks, etc.

Let us now examine the paths which could be instrumental in alleviating or even eliminating formation of such unwanted waste.

Possibilities for Elimination or Alleviation of Wastes

Retaining the Present Technology and Utilize Waste

An example of such a procedure is purification of waste hydrochloric acid from chlorination of organic substances, or purification of sodium sulfite from the production of 2-naphtol.

Modification of Technology

An example of this approach can be use of more selective catalyzers, recovery of excess raw materials, such as ammonia in Bucherer's reaction, alcohol during esterification, returning unwanted products into the production cycle in balanced reactions, e.g., reclaiming diethyl aniline in the production of monoethyl aniline, or, finally, a suitable substitution of raw materials. An example may be use of acid ion exchangers as esterification catalyzer in lieu of sulfuric acid, or substitution of original acidifying of Tobias' acid by inorganic acid while acidifying Tobias' acid by oxy-Tobias' acid and thus closing the production cycle.

Of effective help in this sphere can be utilization of the principle of the maximum driving gradient. As things are, in chemical technology most chemical or physical processes progress in such a manner that they can be described by differential equations of the first order. It is then up to the actual arrangement to achieve optimum conditions. An illustrative example can be provided by a heat exchanger which in the selected specific case in "parallelflow" arrangement has a 100 percent efficiency, in "crossflow" arrangement has a 100 percent efficiency, in "crossflow" arrangement 125 percent, and in "counterflow" arrangement 145 percent. Similarly, during extraction in one stage it is possible in a certain specific case to obtain an 80 percent yield, by dividing the extraction agent into three stages the yield can be 92 percent, and counterflow arrangement yields 98.8 percent. These examples show that through a suitable, i.e., counterflow, arrangement it is possible to attain--in otherwise equal conditions--decidedly better results. For counterflow arrangement of a reaction the most suitable is the distillation column type reactor with which surprising results were obtained, e.g., in counterflow chlorination or esterification of acetic acid.

By means of a suitable arrangement it is possible to substantially increase, e.g., effectiveness of scrubbing suspensions, or improve utilization of reactor capacity by dividing one reactor volume into a cascade of reactors, whereby the greatest change can be expected to occur during transfer from a single reactor to two reactors.

In all of the above examples the principle of maximum driving gradient is adhered to, thus warranting optimum conduct of individual processes from the viewpoint of their velocity.

Replacing Entire Technology or One of Its Key Junction Points by New Waste-free Technology

An example of such problem solution is, e.g., substitution of Bechamp's classical reduction using iron by catalytic hydrogenation, or, e.g., changing the original classical technology of sulfonatic phenol, based on sulfonation of benzene and caustic fusion, by cumene phenol technology; another example can be replacement of Sandmayer's reaction, i.e., intrile group into an aromatic core, by amoxidation process in the gaseous phase, etc.

Analogically, in some technological processes it is possible to replace only individual production steps, e.g., classical sulphonation of napntol during production of Tobias' acid can be replaced by dissolving sulfonation by means of chlorosulphonic acid, whereby the latter is obtained from circulating hydrogen chloride and oxide sulfide as the actual sulfonation agent. Another such example is an attempt to replace classical separation of suloacids by salting by a technology based on a cyclical crystallization process which itself is based on varying temperature dependency as regards solubility of the separated substances, which facilitates devising a closed crystallization cycle without formation of unwanted waste.

Advantages and Disadvantages of Individual Approaches

If, in evaluating the individual approaches to elimination of unwanted waste, we use efficiency criteria from the viewpoint of ecology, expenditure of time and funds as regards research and implementation, then we arrive at the following conclusions:

Minor modifications of technology, such as use of more selective catalyzers, change in technological conditions (temperature, pressure, concentration), reclaiming of reaction components and use of maximum driving power are less demanding as regards time and funds, but their contribution from the viewpoint of ecology is small to medium;

More substantial modifications of technology, such as substitution of technology at a given production step, introduction of flammables into classical productions that previously used aqueous solutions, introduction of closed cycles, purification of waste matter, elimination of waste in salting, wet combustion, etc., pose medium demands during implementation in terms of time and funds, but the resultant effect is better viewed from the ecological standpoint;

Introduction of new "waste-free" technologies, or new "closed" technologies to replace extant technologies is highly efficient from the technological viewpoint, but is demanding as far as time and funds are concerned.

In most cases it will be axiomatic for the chemical industry that costs that will have to be expended will rise in direct proportion to the degree of effectiveness achieved in elimination of wastes.

It will also be necessary to adhere to the principle that is proving its worth in medicine: generation of waste must be prevented by modifying production technology beforehand, rather than by trying to eliminate generated waste ex post facto.

Conclusion

It can be stated in general that solution of ecological problems will always be a complex and demanding task as regards technology, funds, and time, which can be successfully coped with only by close cooperation of personnel from research and design organizations, personnel of the implementing contractor, supply organizations and personnel of superior organs.

It will be necessary to create conditions conducive to furthering their activities in solving ecological problems and introducing "wastefree" technologies.

Research and design personnel will be primarily concerned with introduction of new, mostly catalytic technologies with recycling. Research into such technologies, compared to technologies based on "one pass operation," is

much more complicated specifically because of the possibility of accumulation of various impurities, or catalytic toxins in recycling. Correct determination of the levels of such impurities, or catalytic poisons, calls for very thorough familiarization with individual processes, primarily by using exact and sensi ive analytical methods. Technology with recycling alone will require a knowledgeable chemical engineering approach. Improving the selectivity of production processes will call for measuring, control and automation of production processes, as well as for utilization of equipment and instrumentation facilitating maximum use of driving power, such as counterflow arrangement for extractors, absorption devices, washing and scrubbing facilities, chemical reactors, etc. All this will manifest itself in increased demand on the qualifications of personnel, time and funding schedules for research tasks, time and funding schedules for implementation of the results, as well as demands on instrumentation and equipment for individual work stations.

The plants implementing such measures will have to, among a number of other measures, focus their attention on edifying their personnel toward supporting implementation of new technologies, even though they be more expensive than present systems which often make use of amortized machinery in depreciated installations. Such productions are "cheap" as regards production cost calculations, but pose a significant danger to the environment by the wastes they generate. This kind of low price is maintained at the high cost of polluting the living environment. This is to be countered by penalties as an economic instrument. However, assessment of penalties is taken as if it did not apply to individual operations, it is thought of as applying to the plant as a whole and is not sufficiently directed towards individual operations. Consideration will have to be given to taking measures which would let penalties apply to operational level, so that its personnel can feel its impact "personally." And penalty assessment will also have to be expanded to "salinity" of waste waters.

Finally, specific measures will have to be taken also at the level of control organs. There is no doubt that implementation of "wastefree" technologies will in most cases require increases in research, investment and operational costs.

As an example we can cite data from the USSR, where in the production of benzene it became necessary to provide supplementary investment funds amounting to 960,000 rubles to attain a wastefree technology, whereby production cost per ton of benzene increased by almost 27 percent and specific investment, recomputed per ton of benzene, increased from 171 rubles per ton to 217 rubles per ton. At first glance, wastefree technology would then appear to be economically ineffective. However, when an assessment was made of the overall detrimental effects on the national economy with a view to local losses in forestry, agricultural and communal economy, medicine, industry, etc., it was determined that total damages amounted to 2 million rubles per year. From this viewpoint wastefree technology compared to the old technology became more effective.

If, however, the criterion for incorporation of tasks is solely the economic effect computed by means of valid criteria, then solutions to tasks of the "wastefree" technologies type have a hard time--given the current planning methodology--to be included among the tasks for research. It would appear advisable therefore to incorporate among the criteria for inclusion into research tasks also contributions in the biosphere.

Thus, it will take a number of activities and measures to enable "wastefree" technologies--not in the role of a deus ex machina, but as the result of conscious efforts of all participants--to carry out, in spite of their technological and economic demands, their important mission in the struggle to maintain and improve our living environment.

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LAKE BAYKAL ENVIRONMENT DISCUSSED

Novosibirsk PROBLEMY BAYKALA in Russian 1978 pp 2, 3-7, 294-295

/Table of contents, annotation and foreword from the book "Problemy Baykala" (Problems of Baykal) edited by Corresponding Member of the USSR Academy of Sciences G. I. Galaziy and Doctor of Geographical Sciences K. K. Votinstev, Institute of Limnology, Siberian Department of the USSR Academy of Sciences, Izdatel'stvo "Nauka", 295 pages/

/Text/ Contents

Annotation

Materials of the long-term study of Lake Baykal in the most diverse directions are given in the collective monograph. The problems of the formation of the basin of the reservoir, its neotechtonics, the structure of the underwater topography, geomorphology and morphometry are examined. The hydrology of the lake--the thermal conditions and heat balance, the dynamics of the water bodies and the radiation conditions--are discussed. The composition of the water, the hydrochemical conditions, the chemical runoff and the balance of matter, the circulation of individual elements are characterized. The origin and evolution of the fauna and flora of the lake, their composition, degree of endemism and biogeographical connections are spoken about. Questions of biological productivity, beginning with the primary production of phytoplankton, through zooplankton to the ichthyofauna and mammalia (fish, the nerpa) are discussed. The processes of the transformation of organic matter in the food chain of the pelagic zone are characterized quantitatively.

The book will be of interest for a wide range of specialists--limnologists, geographers, geologists, chemical hydrologists and hydrologists, hydrobiologists and ichthyologists, workers of the national economy, who are involved with problems of the efficient use of the natural resources of the lake and its watershed, as well as instructors, graduate students and students of higher educational institutions.

Foreword

The results of lengthy studies of the largest reservoir of clean fresh water in the world--Lake Baykal--are summarized in this book. The decree of the

CPSU Central Committee and USSR Council of Ministers of 16 June 1971, "On Additional Measures to Ensure the Efficient Use and Conservation of the Natural Resources of the Watershed of Lake Baykal,"* and other instructions of the party and the government have given a certain purposefulness and specificity to the activity of scholars. The studies are most closely connected with the development of the productive forces of Siberia.

The exceptional uniqueness of Baykal among the largest lakes of the world is universally recognized. But it is not always appraised with adequate breadth and depth. Meanwhile a clear idea of what truly imparts to Baykal a unique and inimitable nature is of the greatest importance for the correct solution of the problems of the most efficient use of the natural resources of the lake and its watershed, on the one hand, and the preservation of the unique properties characteristic of it, on the other.

Lake Baykal has a large number of features, which place it in an exceptional position. In depth (1,620 m) it greatly exceeds all the continental water bodies of the world, while in the volume of the body of water (23,600 km^3, or about one-fifth of the world reserves of surface fresh water) it exceeds all the fresh water lakes of the world. The bottom of the Baykal basin lies 1,165 m below the surface of the world ocean. The morphology of the basin is also unusual. Let us take such morphometric indicators of it as the average depth, that is, the ratio of the volume of the water body to its surface (V/A = 700) and the magnitude of the ratio of the average depth to the greatest depth ($H_{aver}/H_{max} = 0.43$). Their values indicate the enormous volume of the deep-water area and the limitedness of the littoral shoals.

It is well known that Baykal is a very cold lake. The average annual temperature of the surface waters is about 4.5°C. In the summer it does not exceed 11-12°. While the entire enormous body of water, which occurs deeper than 250 m, has year round an almost invariable temperature of 3.2-3.6°.

The waters of Baykal are notable for exceptional transparency, which is the greatest in general for lakes, and for a remarkable blue-green color of varying intensity. Both attest to the great "cleanness" of the Baykal waters, that is, the minimum content in them of suspended particles of varying composition.

But, undoubtedly, the most outstanding feature of the reservoir consists in the richenss and diversity of its fauna and flora, which acquired world renown after the remarkable discoveries of B. I. Dybovskiy in the second half of the 19th century and later fauna studies. Of the 2,400 species and subspecies of the hydrobiota of Baykal about three-fourths are endemic. Among the hydrophytes about 500 species are endemic. But in the appraisal

*"Spravochnik partiynogo rabotnika" /Handbook of the Party Worker/, Issue 12, Moscow, 1972, p 76.

of the uniqueness of the Baykal fauna the fact that not only species, but also entire genuses and higher taxonomic units--families of living inhabitants of this lake--are endemic, should be considered especially important.

It would also be possible to indicate other characteristic features of Baykal. But none of them, taken separately, reveals completely the uniqueness of this reservoir as a complicated natural complex, as a unique and inimitable ecosystem.

During the scientific study of Baykal not only was the knowledge of individual features of its uniqueness, as well as of the entire history of the formation of the giant intermontane depression increased, but the ideas about the genetic links between the individual components of the unified ecosystem of Baykal and about the laws of the combination in it of specific physical, chemical and biological processes were extended. It is becoming more and more obvious that precisely these interrelations with the physico- and biogeographical features of Baykal distinguish it from all other lakes of the world, in which both the individual components of the limnic processes and their interrelations are simpler and not as individual as in the Baykal reservoir.

The causes of the uniqueness of the Baykal limnic complex and the means of its formation have not yet been fully studied. There are serious grounds to explain this uniqueness by the antiquity of the formation of the giant intermontane depressions of the Stanovoye Uplift, in one of which, apparently back at the end of the Tertiary, a system of lakes, the predecessor of modern Baykal, began the path of its origination. Over a long period unique landscapes formed in the watershed of Baykal and on the slopes of its basin. Under the conditions of such landscapes a water, chemical and solid runoff from the catchment of the lake was formed and its components acquired greater and greater uniformity. The entire complex of bottom hydrochemical and biological processes, which determine the high quality of the clean waters with an extremely small content in them of dissolved and suspended substances and the constancy of the composition, also formed under the same stable conditions. The diverse organic ties of the lake reservoir with its watershed were most fully expressed precisely in this.

The origin of the unique endemic fauna and flora is inseparably connected with the antiquity of Baykal, with all the complexity of its coming into being, the formation of the morphological features of its basin and the physical geographical peculiarities of the watershed. There is no doubt that the existence of endemic hydrobiota is possible only in the presence of specific chemical and physical properties of the waters--their low mineralization, the ionic composition, great transparency and a constant low temperature. But the fauna of Baykal is connected not only with these properties of its waters. It is also possible to suggest other, still inadequately studied, but very important peculiarities of the water environment, which play a significant role in the preservation of the endemism of the fauna and flora. Cases, which confirm this assumption, are well known. Suffice it to recall the existence in Baykal of two complexes of hydrobiota--

the Baykalan and general Siberian (littoral-sor)--which to a certain extent have been localized and are spatially isolated. It is also possible to indicate the limited capability of individual Baykal endemic plants to be transplanted in other reservoirs.

Without dwelling in more detail on these questions, let us note: what has been said far from exhausts what we now already know about the close interrelations of the biological and abiotic components of the Baykal ecosystem. Undoubtedly the connections, which arose under the conditions of the great antiquity of Baykal and acquired constancy and stability, precisely lend the Baykal ecosystem its unique nature. Such or at least similar continental water ecosystems no longer exist on earth.

It is therefore quite understandable that the problems of the maximum and effective use and at the same time the conservation of the natural resources of Baykal and its watershed, given the present development of economic activity, are exceptionally complicated. Obviously, none of the patterns and norms, which are suitable for other conditions and regions, can give here a reliable solution to the problem. The sharply pronounced individual nature of the Baykal ecosystem also requires only an individual approach to it.

As a result of long and diverse scientific studies extensive material on the natural conditions and peculiarities of the lake has been accumulated, a number of scientific conclusions and generalizations of general theoretical importance have been drawn. The knowledge of individual aspects of the overall conditions of Baykal has reached a level, which has afforded an opportunity for their use in the solution of crucial practical problems. It is possible to mention the rather complete knowledge of the hydrologic balance and its level conditions for the valid forecasting and regulation of the conditions of the operation of the Angara cascade of reservoirs. The data on the hydrochemical conditions, the low mineralization and the constancy of the ionic composition of the waters were of definite importance in discussing the question of their use for the production of high-grade cellulose.

At the same time much in the complicated Baykal ecosystem still remains unclear, and we cannot give a confident answer to a large number of important questions. Deep differences over them continue to exist among specialists in various fields of science and practice and the debates, which often assume a pointed and fundamental nature, are not ending.

Although, in the unanimous opinion of the participants in the 19th International Limnological Congress, Baykal is considered the best studied among the major lakes of the world, we cannot be content with the state of the study of questions of the possible use of its renewable and unrenewable resources. There are no completely sound estimates to the level of development of the productive forces in this region in the future and the limits of the concentration here of industrial and other works, in case of which it would be possible to preserve the ecosystem of the lake, have not been

estimated. The inadequacy of such scientific knowledge is becoming more and more perceptible at this time, when the rapidly growing economic development of Eastern Siberia, including Baykal and its watershed, requires the making of sound decisions for the near and distant future.

It is not to be doubted and no one denies that the ancient and unique Baykal ecosystem, the exceptional qualities of the Baykal waters and all the natural factors and conditions, which create and maintain them, should be preserved as the only natural phenomenon of its kind, the greatest national valuable and pride of the Soviet Union. All this should be preserved both as a resource of much practical knowledge for the future and as the habitat of the Baykal hydrobiota and ancient endemic fauna and as a condition of its reproduction. In other words, the links of the individual components of the entire Baykal ecosystem, which constitute its unity, should remain undestroyed.

These problems face science first of all and require the strict orientation of all research.

However, we do not yet have adequate scientific data on the nature, direction and extent of the effects of anthropogenic disturbances on some aspects of the conditions of Baykal in the broadest sense of the word. Purposeful research work, with the extensive organization of observations and the conducting of experiments, which have been worked out with allowance made for the natural conditions of Baykal and its watershed, is obviously necessary in this area.

Two main directions can be distinguished in the research. The goal of the first is the elaboration of the theoretical bases of scientific recommendations, which in the area of forest use would ensure the constant maintenance of the water conservation properties of the Baykal taiga, while in the area of agricultural use would eliminate the threat of the development of erosion and aeolian processes within the watershed of Baykal. The second direction is the study of the links between the changes in the conditions of the formation of the liquid, dissolved and solid runoff on the catchment of the watershed of Baykal and the disturbances of the main indicators of the conditions of the lake. Quantitative expressions should be found for characterizing the links, which is necessary for the calculations of forecasts and the substantiation of practical recommendations.

The elaboration of the scientific principles of the use and conservation of the natural resources of Baykal and its watershed in its scale and complexity is unprecedented in world science. The fact that in this case scientific decisions are being given for the socialist planned economic and socialist economics, is also new. This makes it clear that success in the elaboration of the problems of Baykal should be ensured by the participation of creative collectives, which include an extensive group of specialists of our country.

The topicality of the monograph on the studies of Baykal, which is being offered to the attention of the readers, in many ways is increasing in

connection with the construction of the Baykal-Amur Main Rail Line (BAM). The main line will pass over a considerable stretch along the watershed of the lake. An influence of BAM on the natural balance in the region of Baykal is inevitable.

For convenience of perception of the material the offered book is broken down into 5 thematic parts and 23 chapters. Each section begins with a brief history of the studies on the questions examined in it. The outcome of the studies, the evaluation of their results and practical recommendations are given in the chapters. In the conclusion of the monograph the reader will find the most important conclusions and recommendations on all the main issues touched upon in it and a program of further scientific research for the purpose of elaborating the most efficient methods of the use and conservation of the natural resources of a unique region of our homeland.

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INTERNATIONAL AFFAIRS

LAKE GENEVA'S POLLUTION PROBLEM DESCRIBED

Paris L'EXPRESS in French 9 Aug 80 pp 1-2

[Article by Sylvie O'dy: "Lake Geneva: Flawed Beauty!"]

[Text] "As I turned 13, I had to leave school to help my father, a fisherman. I still remember the lake's morning smell in summer. There were hay-mown sweet smells in the air. If thirsty, I would just drink its water directly. Then, in the village, a dozen families were making a living from fishing. Today, there are only two left, and nobody dreams of drinking lake water." Paul Jaquier, Yvoire's mayor, a picturesque village on Lake Geneva's French shores, nostalgically recalls these happy times, when modern activities had not yet had an impact on lake waters.

Created some 120 centuries ago, as a product of the last major glaciation, the largest lake in Western Europe had since lived in peace. But in just 25 years, this preciously created equilibrium has been destroyed. Lake Geneva which still appears in fine condition, surrounded by mountains and hills, has now become gravely ill. A peaceful mood envelops everything, sail boats and sail surfers glide silently on its surface. Who could believe that such a quiet mass of water is dying?

It was first noted, 20 years ago, by fishermen who started collecting abnormal amounts of algae in their nets. They were astonished, then alarmed--specialists too. But ecology was not in fashion yet. However, the two riparian countries--France and Switzerland--decided to create a very official "Lake Watch Committee", in 1960. By November 1967, for the first time, scientists discovered a microscopic algae "oscillatoria rubescens", which colors water red, thus commonly known as "Burgundians' blood" to recall Charles the Bold and its defeat at Grandson. There could not be anymore doubt: such a proliferation is an undeniable sign of water in a diseased state.

Chars' Demise

What ails Lake Geneva? Eutrophication. This anomaly well known of limnologists, or lake specialists, manifests itself by increased water turbidity, an explosive development of certain algae, a growing scarcity of fish species among the most prized ones. It is produced by excessive inputs of phosphorus and nitrogen, which induce an abnormal growth of phytoplankton.

These algae, as they die, will settle on bottoms. They should normally get mineralized, through oxidation by dissolved oxygen. But in an eutrophied lake, waste material is present in excessive quantities. Ecologic equilibrium is destroyed. Slowly, lake bottom layers are deprived of oxygen and die. According to Jean-Bernard Lachavanne--a scientist at the Geneva University laboratory for plant biology--who is president of recently formed Lake Geneva Defense Association: "Our lake suffers both respiratory ills and chronic indigestion."

As could be expected, the inputs of phosphorus and nitrogen responsible for this problem are man-made. Shoreline population and industrial development has multiplied toxic wastes dumped into Lake Geneva. Surface runoffs from fields chock-full with fertilizers do also contribute to its pollution. True, every urban and industrial waste waters are supposed to be treated before discharging them into lake waters. But phosphorus removal, which can be done through a special process, is far from being total. Some water treatment plants do not have the required equipment. Thonon-les-Bains plant, for instance, will not be effective before next fall. Others are improperly used. In 1979, only 15 of the 57 water treatment plants located around the lake basin were releasing treated waters with phosphorus levels within legal limits.

There is another worry: mercury, feared since the Minamata Bay incident in Japan. It was discovered, in 1972, that Lake Geneva was receiving some 10 to 15 kilogs of mercury per day. This heavy metal can move through the whole food chain, and man can be poisoned by eating contaminated fish. Luckily, this extreme situation has not been reached. Gourmets can enjoy lake fish fries without fear. Analyses have indicated that mercury levels in fishes are below the limits recommended by World Health Organization. But some 50 metric tons of mercury are already accumulated on the late bottom. Sharply admonished, Swiss chemical plants located along the Rhone River, up stream from Lake Geneva, have done their utmost to control this: now, they release only half a kilog of mercury per day.

Has the lake been saved? The unanimous answer from fishermen on both sides is no. Most prized fishes--char and dace--are slowly disappearing; replaced by more resistant species--roach and stickleback--not much appreciated by gourmets. Perch, which were still numerous a few years back, have also become rare. Logically, fishing regulations should be modified. But Swiss and French fishermen have never been able to settle on a fishing agreement. And nobody wants to operate under more stringent rules than his neighbor does.

Last October, a local Swiss television station did broadcast an in-depth program under the title "Lake Geneva's Last Gaps." The same program was shown in the French village Allinges, early last July, by the Lake Defense Association. It has scared its viewers. Local elected officials do feel somewhat powerless. "It makes us sick to see our lake in such shape," states Paul Jacquier. "It is a critical juncture, all can be lost. But the problem is no more on a scale where local communities can solve it alone. The two countries must act swiftly."

Rene Monod, secretary of Franco-Swiss Lake Watch Committee, remains optimistic. He refers to a recent decision of the City of Geneva to financially backup all shoreline communities which remove phosphorus from their waste waters. True, Geneva is in a somewhat privileged situation. It gets its drinking water from the lake and, contrary to other communities, its urban waste waters are discharged into the Rhone River without having to be freed of phosphorus, a costly treatment. Will this Genevese initiative trigger follow-up actions from Swiss and French authorities?

Lakes can die, as we have learned recently. In Savoy, Bourget Lake came close to dying. Asphyxiated by catastrophic eutrophication, it was not attracting swimmers or tourists much anymore. Its beauty hardly covered up the extent of damage. While its natural capacity to dispose of phosphorus was 30 metric tons per year, Bourget Lake actually received some 300 metric tons; three-quarters of it produced by Chambery and its industry! An intercommunal waste water authority for Chambery and Aix-les-Bains, backed-up by state authorities, did undertake a major project to restore lake quality. The solution retained: to collect all waste waters of shoreline urban areas and industries after primary treatment and discharge them directly into the Rhone River. A gigantic and expensive project, which required driving a 12 km tunnel through Chat mountain. This tunnel was put in operation last January. Andre Blin, head of intercommunal authority for Aix-les-Bains and main promoter of the project, cannot hide his joy: "It is an extraordinary enterprise. The water has already almost regained its transparency." Pierre Balland, in charge of water quality control at the Water, Forest and Agricultural Engineeering center in Aix-les-Bains is more reserved. In his opinion, only after 1 or 2 years will results have to be judged. But he does not doubt the efficacity of the action accomplished: "A shock treatment was required, a surgical intervention. This has been done."

Annecy Reborn

What satisfy some peoples may not always please others. Shoreline communities along the Rhone River are certainly not happy. Arguing against what they label "a pollution transfer," 24 of them went to court to block right of eminent domain granted to the project. They lost their case in the administrative court in Grenoble. Should one of the most beautiful lakes in the world be sacrificed, when Rhone running waters can more easily absorb this pollution?

Rescuing the great alpine lakes has now become a sort of crusade. Because action was done in time, battle for Annecy Lake was a victory.

Early in the sixties, the concerned communities had taken up the problem. They built a main collector around the entire lake to direct waste waters to a single water treatment plant, which effluent is then discharged down stream into Fier River. Following the system start-up, tourists are flocking around Annecy Lake; char proliferate anew in waters which are transparent again. This successful rescue has given heart to limnologists. But Lake Geneva is another question altogether: with 89 cubic kilometers of water it is a giant in comparison to Annecy Lake. And there has been a suspicion, since diplodocuses had some fatal problems, that rightfully giants are more vulnerable than midgets.

SPAIN

POLLUTION OF BEACHES CONTINUES TO INCREASE

Madrid CAMBIO 16 in Spanish 13 Jul 80 pp 72, 74

> [Text] As if the two horsemen of the apocalypse riding on the Spanish beaches these days--ETA [Basque Fatherland and Liberty Group] (p-m) bombs and prices--were not enough, a third one has made its inexorable appearance: the contamination of waters that should be pure and clear.

And neither the omnipotent administration nor the terrorists are to blame for this. Yet this can be as dangerous as an ETA bomb and as worrisome as one of the major problems afflicting the State. Because the contamination and the filthiness of the waters of our shores are the sources of diseases. And while the bombs of some psychopathic terrorists frighten the tourists, waters that carry diseases can devastate the foreign and domestic tourism that anxiously seeks the Spanish sun these days.

As if the ETA bombs and the outrageous prices of the Spanish coast were not enough, the Ministry of Health has come up with an irrefutable and disturbing report: Spanish coasts do not provide the minimum hygienic or esthetic conditions to ensure the health and enjoyment of vacationers.

It is true, of course, that not all the beaches are contaminated. But according to the report, there are few left that are clean and clear. Figures show it. Of the 174 sample resorts examined by the Ministry of Health, 82 proved dangerous to health according to WHO standards. And meeting health standards is not all that it takes: 87 of them were unsatisfactory from the esthetic standpoint.

The analysis was performed by taking water samples 20 cm below the surface at points 1 meter in depth.

This task of checking the coasts was begun 3 years ago right after a congress held to study the contamination of the Mediterranean coasts. French oceanographer and ecologist Jacques Cousteau had already sounded the alarm: "The condition of the Mediterranean is disturbing. Because of contamination, this sea has lost 40 percent of its capacity to sustain life."

The investigation carried out by the Ministry of Health since then complies with the first measure proposed by Cousteau to save the Mediterranean: to increase the research. Cousteau also advocates that the public be educated, that manufacturers be pressured to clean up wastes, and that strict national and international legislation be enacted and defense committees created. From the standpoint of health, it is important to distinguish between dirty beaches and contamination beaches, as the report of the ministry does. The fact that the beach is littered with plastic bottles and paper and that the water is cloudy from industrial wastes can be unpleasant, but in few instances is it dangerous to health. The same occurs with the "black tides," harmful to the ecological balance of the sea but not very likely to affect health because, after all, there is no need to set up a sign banning swimming when they appear.

Not Everything Uncovered Is Bad

There are instances in which industrial wastes have poisoned bathers when there has been some leak of toxic or banned substances, but this is not common.

The really dangerous beaches, those designated by the report as unsatisfactory from the hygienic point of view, are the ones with bacteriological contamination. The waters and the sands of those beaches, full of fecal residues dumped by the sewer drainpipes of the high-rise apartment buildings and the hotels, contain coli, salmonella, pieces of glass and other substances capable of ruining anyone's vacation. Colitis, conjunctivitis, infections of all kinds, gastritis or rashes are the mildest ailments that the unsuspencting bather can contract in beaches when viruses can cause even cholera and typhoid fever.

Excessive sunning does not help to preserve health. Sunburned skin is more susceptible to the attack of bacteria.

The Worst

Despite the fact that the report published in 1978 sounded the alarm, the authorities have not taken preventive measures. It is estimated that 98 percent of the purifiers installed on Spanish coasts are not working because the municipal governments cannot afford the annual million pesetas required for their maintenance.

On the other hand, the location of the drainpipes that dump the sewer wastes into the sea makes it practically impossible to prevent contamination in many beaches. Such is the case in Benidorm, which in a few years has become a huge summer vacation city yet still has a sewer system like the one it had when it was a small fishing village. The main drainpipe in the city of Benidorm, located in back of the Punta del Caballo mountain, is a constant source of bacteriological contamination and results in the quality of the waters being dependent on the direction of the coastal currents.

In Almeria, the resorts of San Nicolas, Zapillo Villa Sorrento, Garrucha Puerto and Mojacar-Parador do not meet Spanish sanitary standards. In Baleares, the beaches of Can Pastilla and Palma-Sabina are dangerous. The water at Palma Nova and El Erenal is not contaminated, but neither does it have the minimum esthetic quality to make it enjoyable.

In Castellon, almost all the beaches are a disaster and neither Benicasim nor Torrecasim are to be trusted when it is time to take a dip. However, those who go to Burriana and Benicasim-Torreon can bathe without worrying.

In Granada, the beaches of San Cristobal, Altimo, Penon, Motril-Levante and Torrenueva are dirty and dangerous; in Tenerife, only the resort of El Medano is slightly dirty, although the water poses no danger to health. Tenerife has undergone a great improvement compared to last year. In Malaga, the study of the coast has been exhaustive. A total of 47 resorts have been examined, of which 23 meet the sanitary standards and 18 the esthetic ones. In Tarragona, the majority of the beaches checked were clean--only one turned out not to be very satisfactory from the esthetic point of view.

In Huelva, the results have been very satisfactory. According to the 17 resort samples examined, the inhabitants of Huelva and the tourists can bathe and enjoy the scenery without worry--all the beaches are satisfactory.

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